

Lab 6 - Homework

$$1) \quad x[n] = u[n] - u[n-2]$$

$$y[n] = 0,2^n u[n]$$

$$x[n] * y[n] = \sum_{k=-\infty}^{\infty} x[k] \cdot y[n-k]$$

$$= \sum_{k=-\infty}^{\infty} (u[k] - u[k-2]) \cdot 0,2^{n-k} \cdot u[n-k] =$$

$$= \sum_{k=-\infty}^{\infty} u[k] \cdot 0,2^{n-k} \cdot u[n-k] - \sum_{k=-\infty}^{\infty} u[k-2] \cdot 0,2^{n-k} \cdot u[n-k] =$$

$$= \sum_{k=0}^n u[k+n-k] \cdot 0,2^{n-k} - \sum_{k=2}^n u[k-2+n-k] \cdot 0,2^{n-k} =$$

$$= \sum_{k=0}^n u[n] \cdot 0,2^{n-k} - \sum_{k=2}^n u[n-2] \cdot 0,2^{n-k} =$$

$$= u[n] \sum_{k=0}^n \left(\frac{1}{5}\right)^{n-k} - u[n-2] \sum_{k=2}^n \left(\frac{1}{5}\right)^{n-k} =$$

$$= \left(\frac{1}{5}\right)^n u[n] \cdot \sum_{k=0}^n 5^k - u[n-2] \cdot \left(\frac{1}{5}\right)^n \sum_{k=2}^n 5^k =$$

$$= \left(\frac{1}{5}\right)^n u[n] \sum_{k=0}^n 5^k - u[n-2] \left(\frac{1}{5}\right)^n \sum_{k=0}^n 5^k - 6 =$$

$$= \left(\frac{1}{5}\right)^n u[n] \cdot \frac{(5^n - 1)}{5 - 1} - u[n-2] \left(\frac{1}{5}\right)^n \left(\frac{(5^n - 1)}{5 - 1} - 6n \right)$$

$$= \frac{1-5^{-n}}{4} \cdot u[n] - u[n-2] \cdot \frac{1-5^{-n}}{4} + 6n \cdot u[n-2] \left(\frac{1}{5}\right)^n$$

$$= \frac{1-5^{-n}}{4} \cdot u[n] - u[n-2] \cdot \frac{1-5^{-n}}{4} + 6n \cdot u[n-2] \left(\frac{1}{5}\right)^n$$

$$= \frac{1-5^{-n}}{4} (u[n] - u[n-2]) + 6n \cdot u[n-2] \left(\frac{1}{5}\right)^n$$

%Ex1

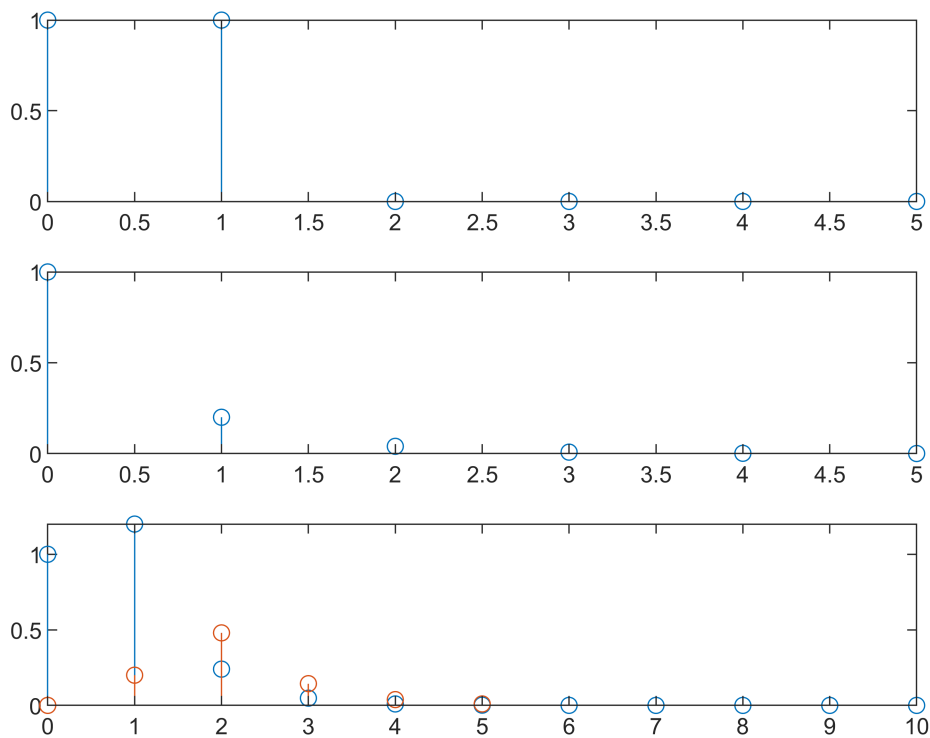
```
clear variables
n = 0 : 5;
u = @(n) (n>=0);
x = @(n) u(n) - u(n-2);
y = @(n) (0.2.^n).*u(n);
sx = 0; ex = 5; dtx = sx : ex;
sy = 0; ey = 5; dty = sy : ey;
dtw = sx + sy : ex + ey;
subplot(3,1,1);stem(dtx,x(dtx))
subplot(3,1,2);stem(dty,y(dty))
w = conv(x(dtx),y(dty))
```

```
w = 1×11
    1.0000    1.2000    0.2400    0.0480    0.0096    0.0019    0.0003    0 ...
```

```
subplot(3,1,3);stem(dtw,w);hold;
```

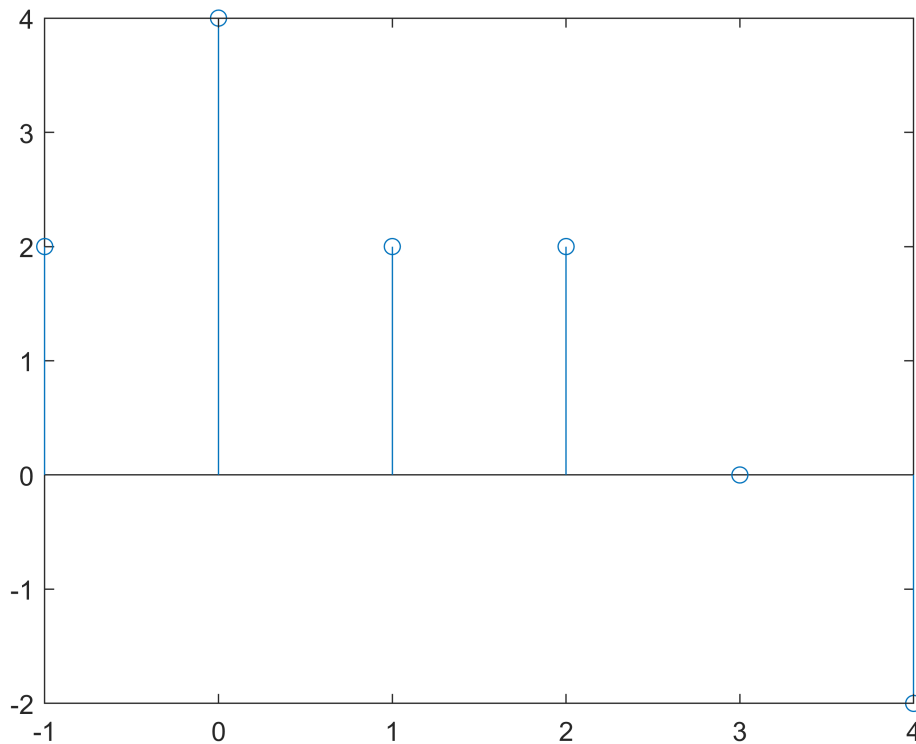
Current plot held

```
stem(n, (1-5.^(-n))/4 .* (u(n)-u(n-2)) + 6.*n.*u(n-2).*(1/5).^n);
```

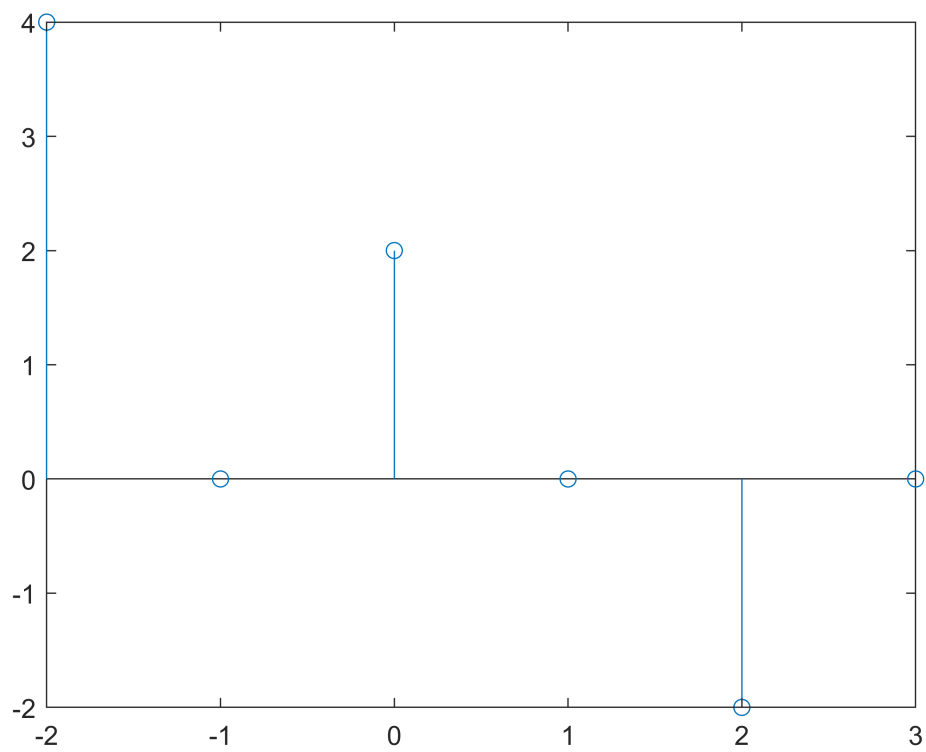


%Ex2

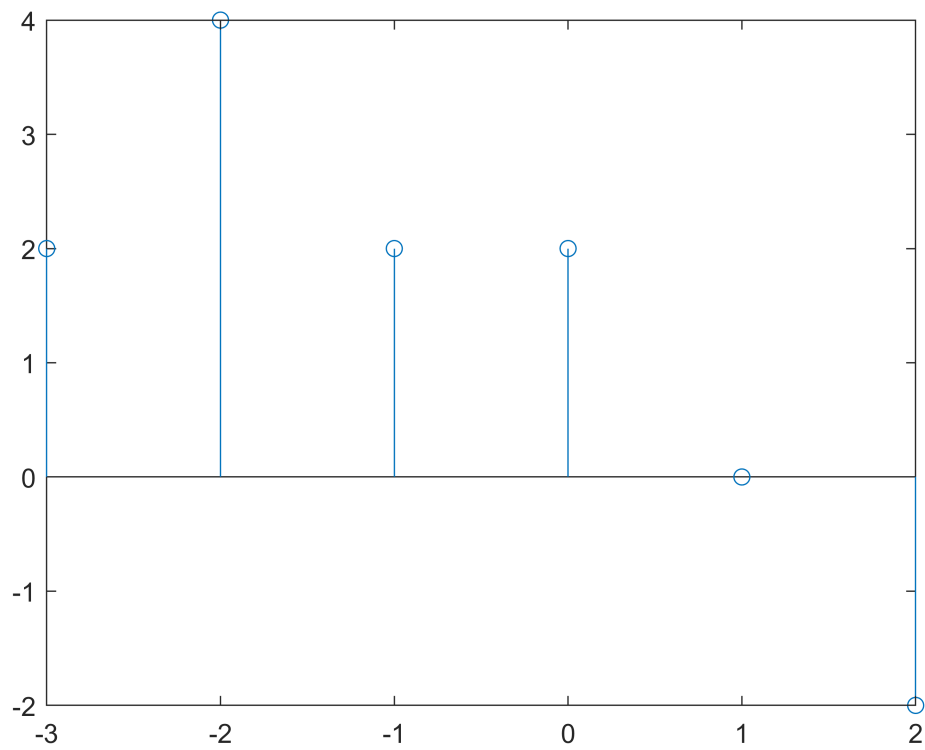
```
clear variables;  
n = -7 : 7;  
delta = @(n) n==0;  
x = @(n) (delta(n) + 2*delta(n-1) - delta(n-3));  
h = @(n) (2 * delta(n+1) + 2*delta(n-1));  
%i  
sx = 0; ex = 3; dtx = sx : ex;  
sh = -1; eh = 1; dth = sh : eh;  
dty1 = sx+sh : ex+eh;  
y1 = conv(x(dtx),h(dth));  
stem(dty1,y1)
```



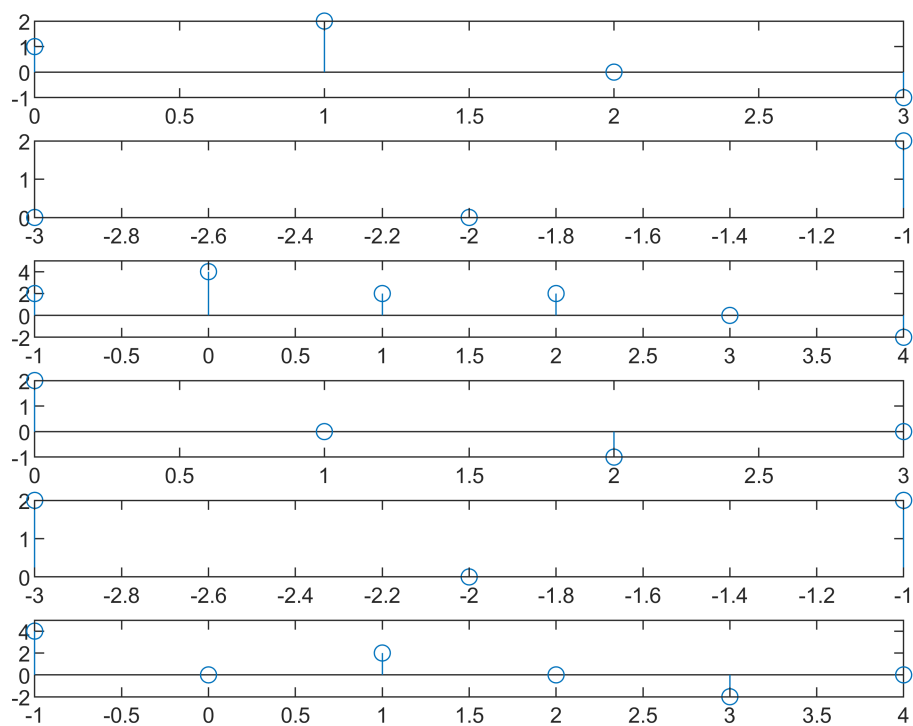
```
%ii  
sx = -1; ex = 2; dtx2 = sx:ex;  
sh = -1; eh = 1; dth2 = sh : eh;  
dty2 = sx+sh : ex+eh;  
y2 = conv(x(dtx+1),h(dth));  
stem(dty2,y2)
```



```
%iii
sx = 0; ex = 3; dtx = sx:ex;
sh = -3; eh = -1; dth = sh : eh;
dty3 = sx+sh : ex+eh;
y3 = conv(x(dtx),h(dth+2));
stem(dty3,y3)
```



```
%b
figure,
subplot(6,1,1), stem(dtx,x(dtx));
subplot(6,1,2), stem(dth,h(dth));
subplot(6,1,3), stem(dty1,y1);
subplot(6,1,4), stem(dtx,x(dtx+1));
subplot(6,1,5), stem(dth,h(dth+2));
subplot(6,1,6), stem(dty1,y2);
```



%Ex3

```
clear variables;
n = -5:5;
delta = @(n) (n==0);
alfa = 0.05;
u = @(n) (n>=0);
x_n = @(n) (delta(n) - alfa*delta(n-1));
h1_n = @(n) alfa*u(n);
sx = 0; ex = 1; dtx = sx : ex;
sh = 0; eh = 5; dth = sh : eh;
h2_n = @(n) sin(8*n);
S1_n = @(n) conv(x_n(dtx), h1_n(dth))
```

S1_n = function_handle with value:
@(n)conv(x_n(dtx),h1_n(dth))

```
output = conv(S1_n(dth), h2_n(dth))
```

```
output = 1×12
    0    0.0495    0.0326   -0.0120    0.0179    0.0538    0.0519    0.0024 ...
```

```
dto = 0:11;
figure,
subplot(4,1,1);stem(dth, h1_n(dth));
subplot(4,1,2);stem(dth, h2_n(dth));
subplot(4,1,3);stem(dtx, x_n(dtx));
subplot(4,1,4);stem(dto, output);
```

